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REPORT FOR CONSULTATION ON THE GREATER
METROPOLITAN CLEVELAND INTRASTATE AIR
QUALITY CONTROL REGION

National Air Pollution Control Administration
Washington, D. C.

February 1969

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16. Abstracts The basic background information is presented for the consultation with state and local authorities prior to the designation of air quality control regions as stipulated in the Clean Air Act. Boundaries for the regions are proposed and the factors which are the basis for the proposed boundaries are discussed. Reports for consultation consider these factors: geography; population and economic activity; their prospective growth; probable direction of physical growth; the emission inventory and the location of sources; air quality and pollution transport analysis; regional planning; air pollution control; and governmental jurisdictions.																						
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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
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PREFACE

The Secretary, Department of Health, Education, and Welfare, is directed by the Air Quality Act of 1967 to designate "air quality control regions" to provide a basis for the establishment of air quality standards and the implementation of air quality control programs. In addition to listing the major factors to be considered in the development of region boundaries, the Act stipulates that the designation of a region shall be preceded by consultation with appropriate State and local authorities.

The National Air Pollution Control Administration, DHEW, has conducted a study of the greater Cleveland area, the results of which are presented in this report. The Region* boundaries proposed in this report reflect consideration of all available and pertinent data; however, the boundaries remain subject to revision suggested by consultation with State and local authorities. Formal designation will be withheld pending the outcome of the meeting. This report is intended to serve as the starting point for the consultation.

The Administration is appreciative of assistance received either directly during the course of this study or indirectly during previous studies from the official air pollution agencies of the affected states and counties, the Seven County Transportation Land Use Commission, the Tri-County Regional Planning Commission, and the Stark County Regional Planning Commission.

*For the purposes of this report, the word region, when capitalized, will refer to the Greater Cleveland Intrastate Air Quality Control Region. When not capitalized, unless otherwise noted, it will refer to air quality control regions in general.

INTRODUCTION

"For the purpose of establishing ambient air quality standards pursuant to section 108, and for administrative and other purposes, the Secretary, after consultation with appropriate State and local authorities, shall, to the extent feasible, within 18 months after the date of enactment of the Air Quality Act of 1967 designate air quality control regions based on jurisdictional boundaries, urban-industrial concentrations, and other factors including atmospheric areas necessary to provide adequate implementation of air quality standards. The Secretary may from time to time thereafter, as he determines necessary to protect the public health and welfare and after consultation with appropriate State and local authorities, revise the designation of such regions and designate additional air quality control regions. The Secretary shall immediately notify the Governor or Governors of the affected State or States of such designation."

Section 107(a), Air Quality Act of 1967

Air pollution, because of its direct relationship to people and their activities, is an urban problem. Urban sprawls often cover thousands of square miles; they quite often include parts of more than one state and almost always are made up of several counties and an even greater number of cities. Air pollution, therefore, also becomes a regional problem, and the collaboration of several governmental jurisdictions is prerequisite to the solution of the problem in any given area. Air quality control regions called for in the above-quoted section of the Air Quality Act of 1967 are meant to define the geographical extent of air pollution problems in different urban areas and the combination of jurisdictions that must contribute to the solution in each.

The regional approach set up by the Air Quality Act is illustrated in

Figure 1. The approach involves a series of steps to be taken by Federal, State, and local governments, beginning with the designation of regions, the publication of air quality criteria, and the publication of information on available control techniques by the Federal Government. Following the completion of these three steps, the Governors of the States affected by a region must file with the Secretary within 90 days a letter of intent, indicating that the States will adopt within 180 days ambient air quality standards for the pollutants covered by the published criteria and control technology documents and adopt within an additional 180 days plans for the implementation, maintenance, and enforcement of those standards in the designated air quality control regions.

The new Federal legislation provides for a regional attack on air pollution and, at the same time, allows latitude in the form which regional efforts may take. While the Secretary reserves approval authority, the States involved in a designated region assume the responsibility for developing standards and an implementation plan which includes administrative procedures for abatement and control.

The basic objectives in the designation of an air quality control region is that it be self-contained, i.e. that the transfer of air pollution out of or into a region is minimized. This objective recognizes the fact that an air quality control region cannot be delineated in a way to make it completely independent with respect to the air pollution problem. Because air pollutants can be carried long distances, the air over a region can be subjected occasionally or even frequently to trace amounts of pollution from other cities and individual sources located outside its boundaries.

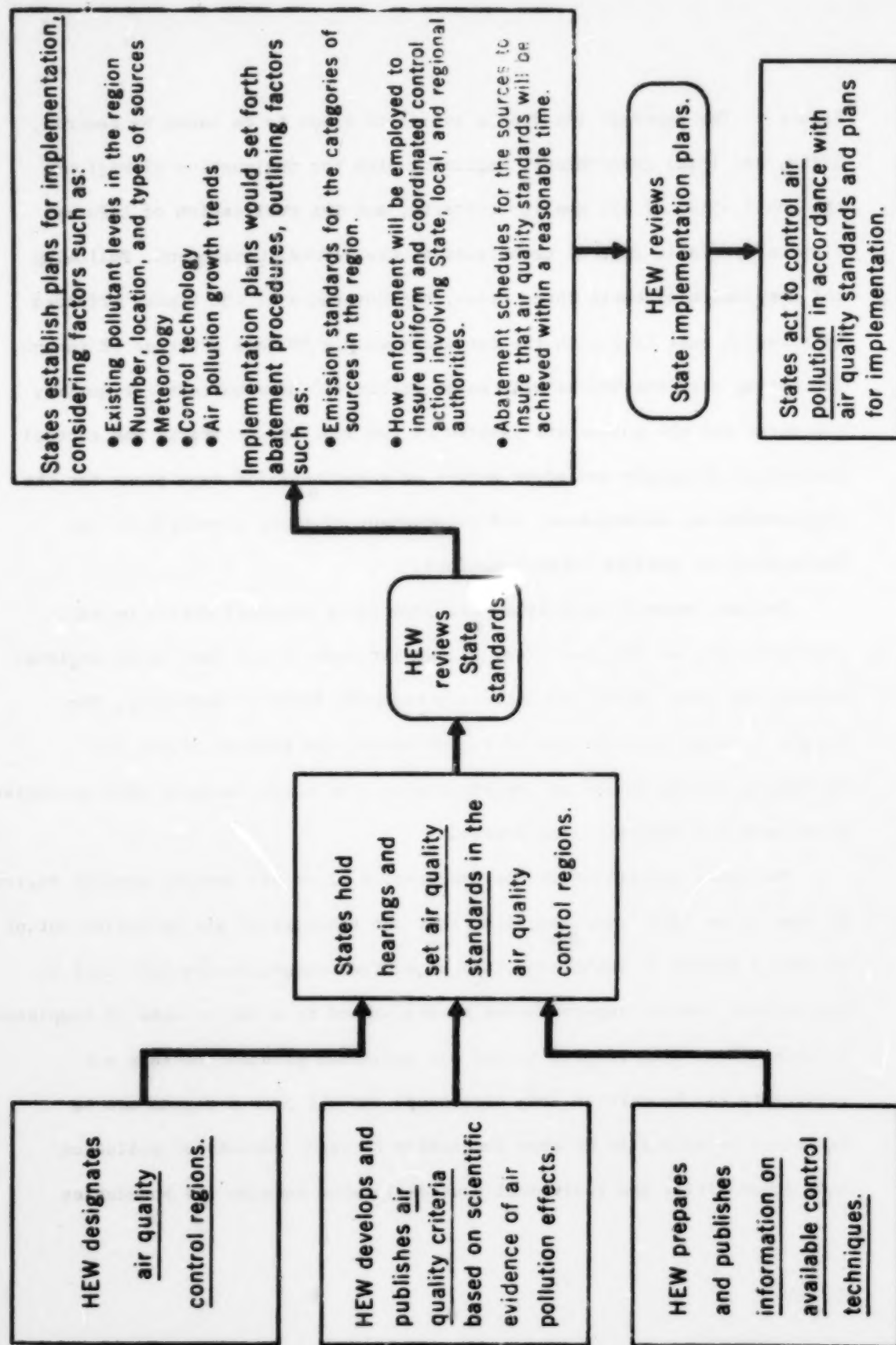


Figure 1. Flow diagram for State action to control air pollution on a regional basis.

Under specific and episodic conditions such contributions can even reach significant quantities. The problem of a boundary designation is further compounded in that urban areas generally do not end abruptly but are surrounded by activities that can contribute to the pollution of the urban area as well as be the recipients of its generated pollution. Consideration of all these possibilities would result in regions substantially larger than is practical or even necessary to get to the brunt of the problem. The primary question, therefore, becomes one of relative magnitude and frequency.

The boundaries of regions, however, should encompass areas that contain sources that add significantly to the pollution load of the air as well as the areas that are significantly and continuously affected by it. For this purpose, the delineation of regional boundaries is based on evaluation of annual and seasonal air pollutant emissions and resultant ambient concentrations rather than those based on short-term and specific conditions.

The selection of regional boundaries should not be based solely on today's conditions and needs but, perhaps more importantly, should give consideration to future development and growth of the area. For this purpose, extensive consideration should be given to prescribed metropolitan plans as well as the forecasted growth. Such considerations should result in the designation of regions that will contain the sources and receptors of regional air pollution for a number of years to come. This is not to say that the regional boundaries should remain stationary and unchanged. Periodic review of boundaries is desirable, and changes in the boundary

should be considered if conditions warrant.

The delineation of region boundaries solely on the basis of source locations and distributional patterns of ambient air pollution would most likely result in regions that do not follow any existing governmental boundaries, are difficult to define, and, more importantly, extremely difficult if not impossible to administrate. It is for this purpose that existing jurisdictional entities are reviewed and wherein practical the boundary lines of a region should include that combination of whole jurisdictions that encompasses the problem area. There can be exceptions to that philosophy, however. The presence of overly large jurisdictions, marked topographical features (mountains), or notable differences in development within a given jurisdiction may, in some cases, make it desirable to include only portions of some jurisdictions.

A region, then, will represent a balance between the various objectives discussed so far to the extent that any two of them lead to different conclusions. The strength of some factors over others may lead to region boundaries which exclude some sources of pollution that might affect the air quality or part or all of the nearby region under certain conditions. Even though the impact of such sources would probably be minimal, the implementation plan required under the Air Quality Act for the region should provide a mechanism for the control of point sources that are located just beyond the region boundary. Such a provision would be consistent with the basic objective of providing desirable air quality within an area being designated as an air quality control region.

Figure 2 summarizes the procedure used by the National Air Pollution Control Administration for designating air quality control regions.

A preliminary delineation of the region is developed by bringing together two essentially separate studies--the "Evaluation of Engineering Factors" and the "Evaluation of Urban Factors."

The study of "Engineering Factors" indicates the location of pollution sources and the geographic extent of serious pollutant concentrations in the ambient air. Pollution sources are located by an inventory of emissions from automobiles, industrial activities, space heating, waste disposal, and other pollution generators. Pollution concentrations in the ambient air are estimated from air quality sampling data and from a theoretical diffusion model. When it exists, air quality sampling data is more reliable than the theoretical diffusion model results since the data is directly recorded by pollution measuring instruments. Unfortunately, in many cases extensive air quality sampling data is unavailable in the rural areas surrounding an urban complex.

The study of "Urban Factors" encompasses all non-engineering considerations. It reviews existing governmental jurisdictions, current air pollution control programs, present concentrations of population and industry, and expected patterns of urban growth. Other non-engineering factors are discussed when they are relevant. As a whole, the study of urban factors indicates how large an air quality control region must be in order to encompass expected growth of pollution sources in the future. It also considers which group of governmental jurisdictions will most effectively administer a strong regional air quality control program.

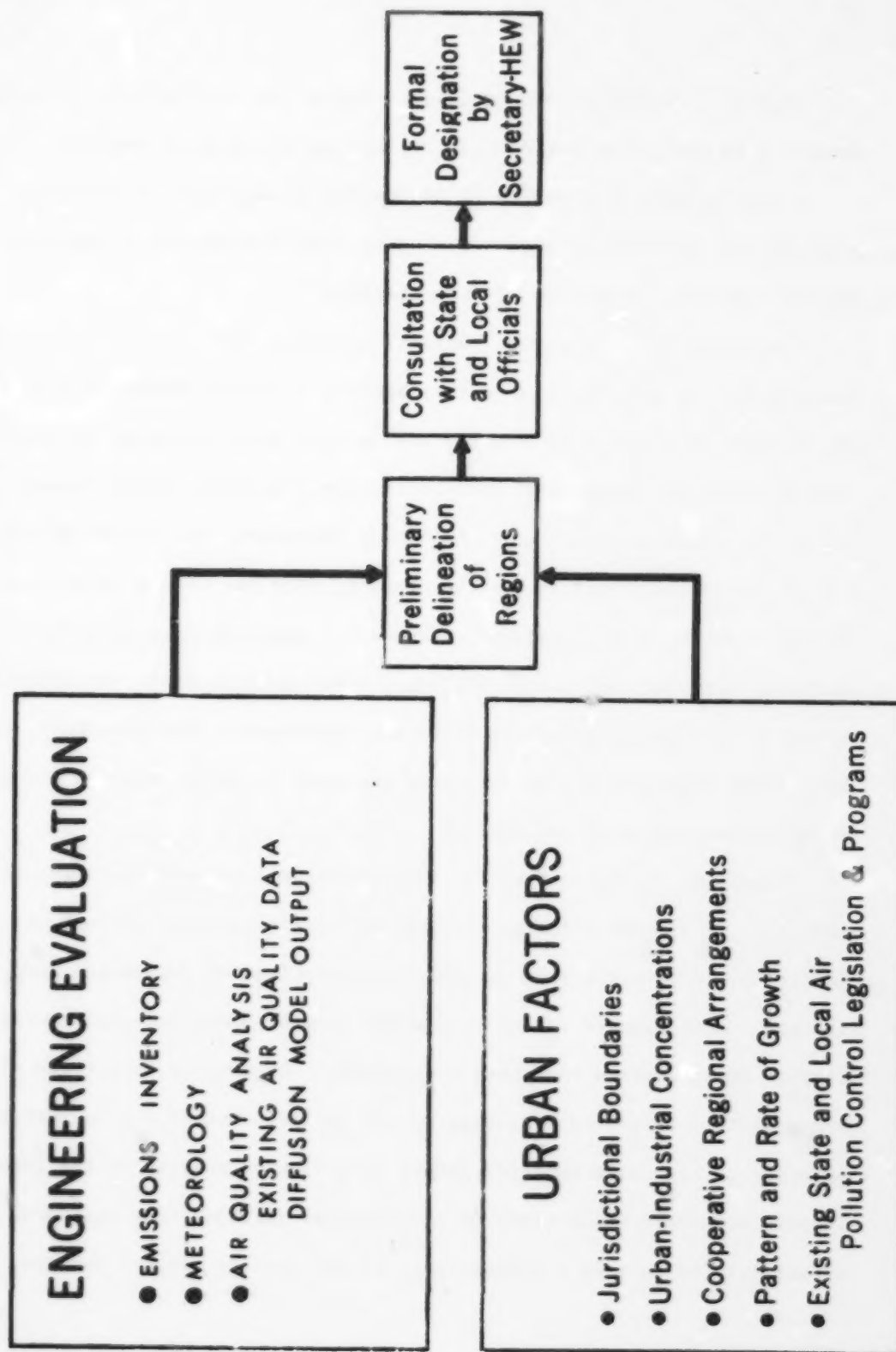


Figure 2. Flow diagram for the designation of air quality control regions.

The conclusions of the engineering study are combined with the results of the urban factors study to form the basis of an initial proposal for an air quality control region. As shown in Figure 2, the proposal is then submitted for consultation with State and local officials. After reviewing the suggestions raised during the consultation, the Secretary formally designates the region with a notice in the Federal Register and notifies the governors of the States affected by the designation.

The body of this report contains a proposal for the boundaries of the Greater Metropolitan Cleveland Intrastate Air Quality Control Region and supporting studies on engineering and urban factors. The report itself is intended to serve as the background document for the formal consultation with appropriate State and local authorities.

EVALUATION OF ENGINEERING FACTORS

The engineering evaluation for the Cleveland area was based on a study of pollutant emissions, meteorology, topography, estimated air quality levels and available ambient air quality data. The emission inventory indicated the location of point and area sources, the quantity of pollutants emitted from these sources, and the resulting emission densities. These data were subsequently used in a diffusion model¹ to estimate air quality levels in the Cleveland area.

EMISSION INVENTORY

The National Air Pollution Control Administration* conducted an inventory of air pollutant emissions for the Cleveland area. Three major pollutants--sulfur oxides, carbon monoxide, and suspended particulates--have been considered in previous studies by NAPCA to aid in designating air quality control regions. These three pollutants provide some measure of the general geographic extent of the overall problem. Sulfur oxides pollution levels illustrate the impact of fuel burning activities at stationary sources. Levels of carbon monoxide provide the best indication of the impact of gasoline-powered motor vehicles on the regional air pollution pattern. Particulate emissions indicate primarily the extent of industrial, power, incineration, and heating sources. Results of the emission inventory are tabulated in Table 1.

* The Abatement Program of NAPCA

TABLE 1

POLLUTANT EMISSIONS BY SOURCE CATEGORY
AND POLITICAL JURISDICTIONS IN THE CLEVELAND STUDY AREA
(tons per year)

COUNTY	FUEL COMBUSTION SOURCES					Ind. Process	Trans.	Refuse Disposal	Total
	Ind.	Comm. & Inst.	Resident al	Power Plants	Total Fuel				
Sulfur Oxides	Lake	10,370	661	2,312	103,634	---	553	23	117,553
	Summit	132,728	2,447	4,572	153,799	---	1,508	66	155,373
	Portage	4,450	419	2,586	7,455	---	306	10	7,771
	Lorain	79,988	1,061	2,052	91,053	181	978	28	175,361
	Medina	2,842	354	1,289	---	---	230	8	4,723
	Geauga	2,486	184	1,132	---	---	123	5	3,930
Sulfur Oxides	Cuyahoga	175,669	17,887	10,154	82,743	197	6,354	326	293,330
	Stark	49,691	1,876	7,874	---	7	899	37	60,384
	TOTAL	458,224	24,889	31,971	291,482	385	10,951	503	810,405
Particulates	Lake	4,045	91	531	14,939	---	840	642	21,088
	Summit	35,888	306	1,198	3,668	---	2,778	1,569	45,407
	Portage	1,735	235	553	---	---	536	338	3,397
	Lorain	14,709	135	529	12,731	33,062	1,250	716	63,132
	Medina	1,124	36	268	---	---	421	247	2,096
	Geauga	991	101	275	---	---	226	230	1,823
Particulates	Cuyahoga	32,796	3,982	2,904	8,535	54,192	8,764	4,921	116,094
	Stark	26,882	1,028	1,729	---	18,292	1,660	969	50,560
	TOTAL	118,170	5,914	7,987	39,873	105,546	16,475	9,632	303,597
Carbon Monoxide	Lake	267	29	811	453	---	71,784	2,158	75,502
	Summit	910	103	1,828	11	---	234,709	5,422	242,988
	Portage	114	155	1,053	---	---	49,685	1,162	52,169
	Lorain	652	30	817	387	---	98,704	2,370	102,960
	Medina	74	15	523	---	---	36,591	838	38,041
	Geauga	66	72	498	---	---	20,241	810	21,687
Carbon Monoxide	Cuyahoga	1,642	657	4,282	363	3,000	653,580	13,331	676,855
	Stark	1,040	625	3,340	---	25,000	140,948	3,220	174,173
	TOTAL	4,765	1,691	13,152	1,214	28,000	1,306,242	29,311	1,384,375

The Cleveland study included estimates for the counties of Lorain, Cuyahoga, Lake, Geauga, Portage, Summit, Medina, and Stark. The area was divided into the grid coordinate system shown in Figure 3. The estimated annual emissions of each of the three pollutants by grid zone were converted to average daily emissions for average annual, winter, and summer days². Average annual emission densities for each of the three pollutants in tons/square mile/day were determined by relating the total quantity of pollutants emitted in each of the grid zones to the land area of each zone.* The resulting emission densities are shown graphically in Figures 4, 5, and 6. The general pattern of emission densities for each of the three pollutants is closely related to the pattern of urbanization in the Cleveland study area.

Major point sources contributing to the air pollution problem are shown in Figure 7.

AIR QUALITY ANALYSIS

The geographical distribution of pollutant sources illustrates the core of the problem area. It does not, however, elucidate the extent of the influence of pollution sources on the people and property located outside the highly urbanized portion of the Cleveland area. A study of air quality levels known or estimated to occur is useful in determining the area affected by the pollution sources and thus subject to inclusion in the Air Quality Control Region. Such analysis can be based directly on air sampling data in those instances where the sampling program covers a large enough area and has been in existence long enough to

* In those cases where a grid zone extends out of the study area and into another county (for example, grids 60-63), only that portion of the county within the study area was used to determine emissions and land area.

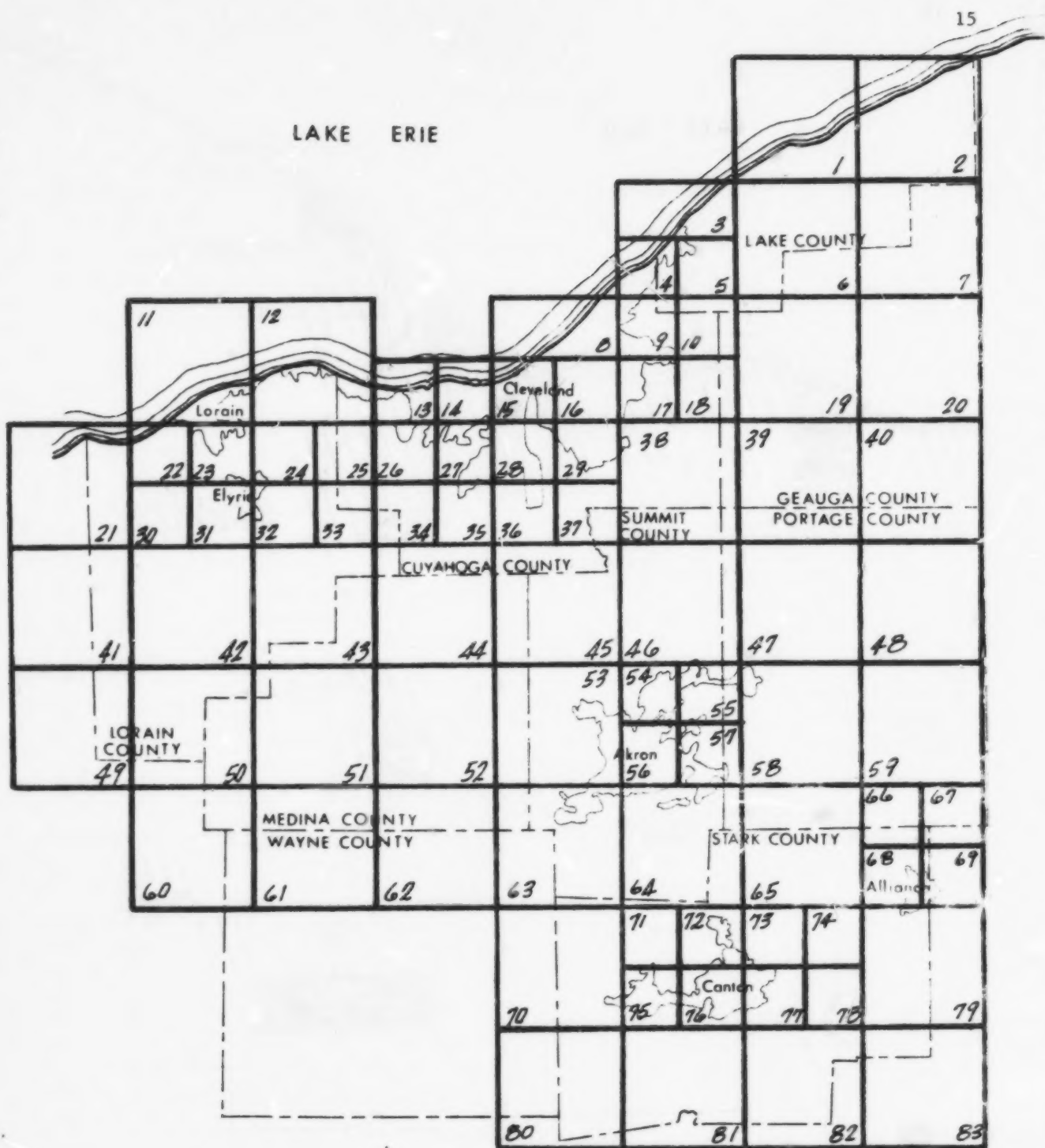


Figure 3. Grid system for Cleveland study area.

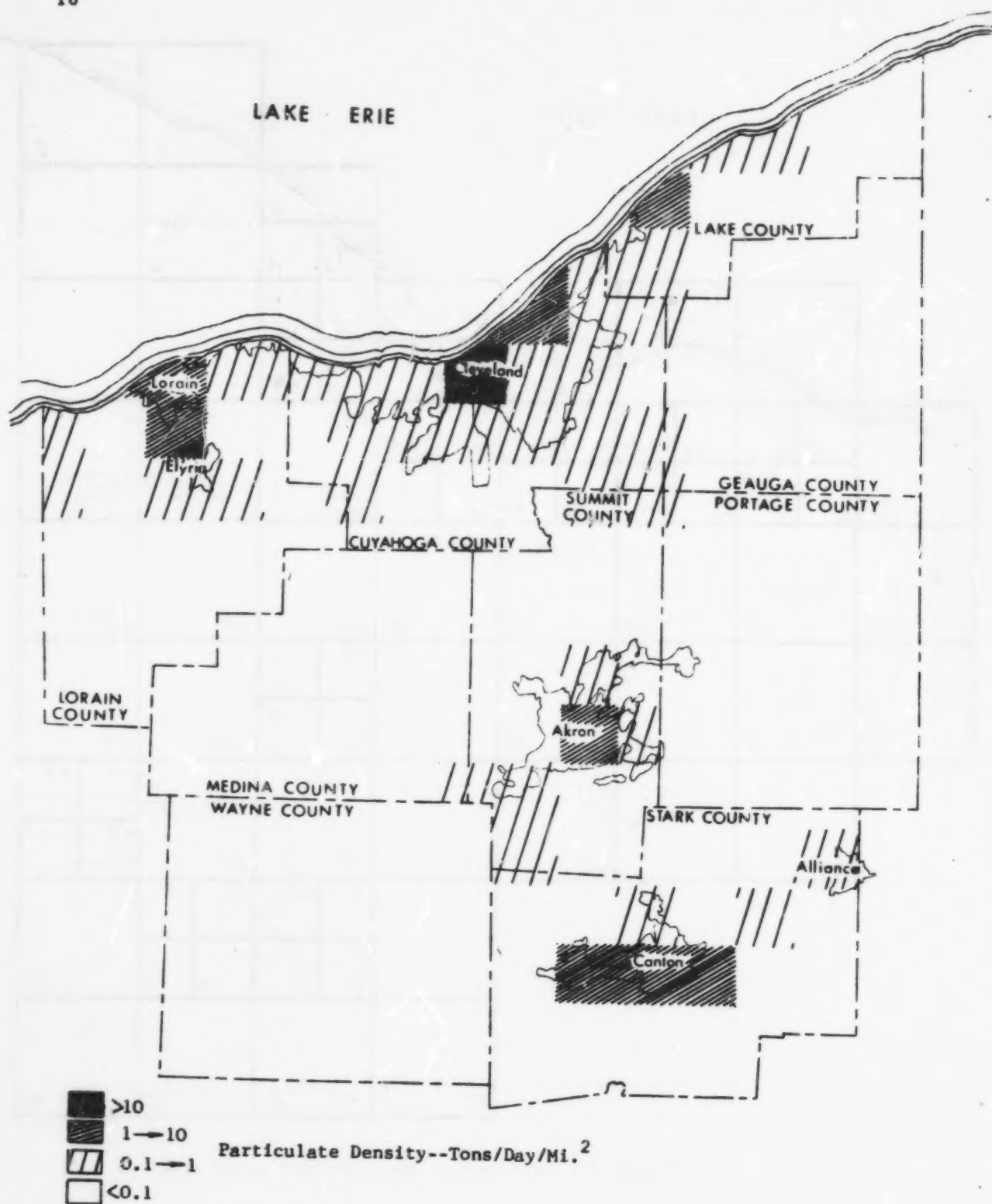


Figure 4. Particulate Emission Density by Study Area Zone, Winter Average

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Figure 5. Carbon Monoxide Emission Density by Study Area Zone, Summer Average

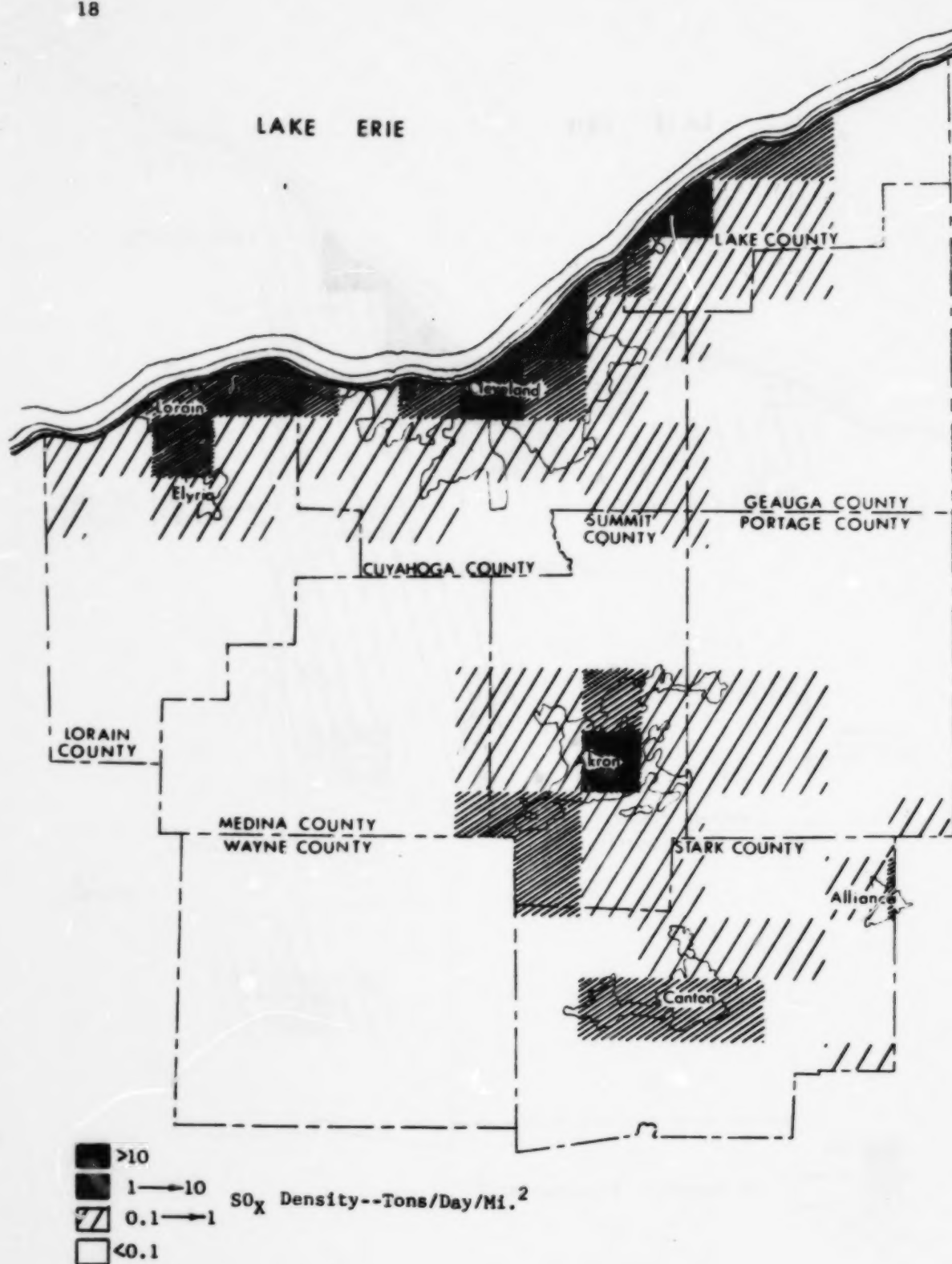


Figure 6. Sulfur Oxides Emission Density by Study Area Zone, Winter Average

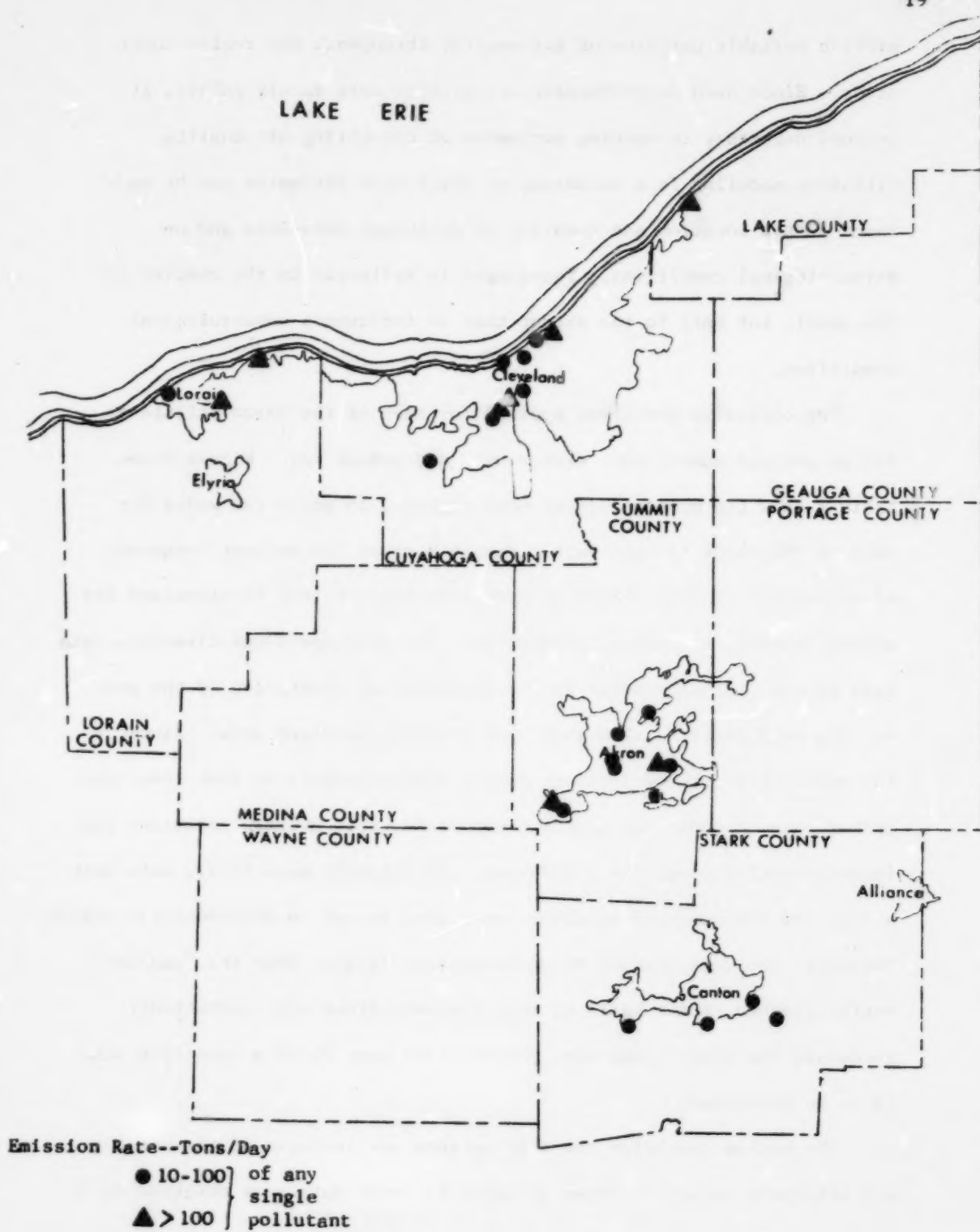


Figure 7 . Major Point Sources

provide reliable patterns of air quality throughout the region under study. Since such comprehensive air quality data rarely exists, it becomes necessary to develop estimates of prevailing air quality. Diffusion modeling is a technique by which such estimates can be made based on the location and quantity of pollutant emissions and on meteorological conditions. Topography is reflected in the results of the model, but only to the extent that it influences meteorological conditions.

The diffusion model was applied for each of the three pollutants for an average summer day, winter day, and annual day. Figure 8 and Table 2 show the meteorological data required to apply the model for each of the three average days. Figure 8 shows the percent frequency of occurrence of wind direction from 1951 through 1960 in Cleveland for summer, winter, and annual conditions. The wind speed and direction data used in the diffusion model were considered representative of the prevailing wind patterns throughout the general Cleveland area. Since the Martin-Tikvart model¹ used in this study attempts to show long-term rather than episodic air quality conditions, only average emissions and long-term meteorology are considered. If episodic data (i.e., data with a very low frequency of occurrence were used to aid in delineating a region boundary, the region would be unnecessarily large. Even the "smaller" region defined on the basis of mean concentrations will undoubtedly encompass the area of maximum concentration upon which a reduction plan is to be developed.

The mixing depths for the time periods are averages of the morning and afternoon values as shown in Table 2; these data were obtained from

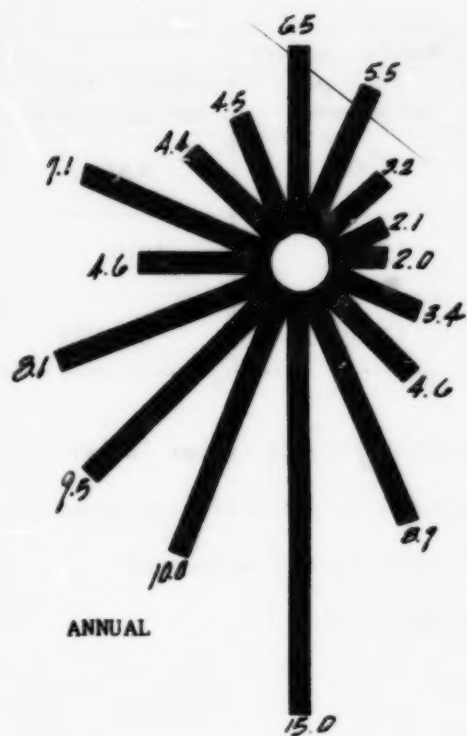


Figure 8. Percent frequency of wind direction for various averaging times, based on 1951-1960 data.

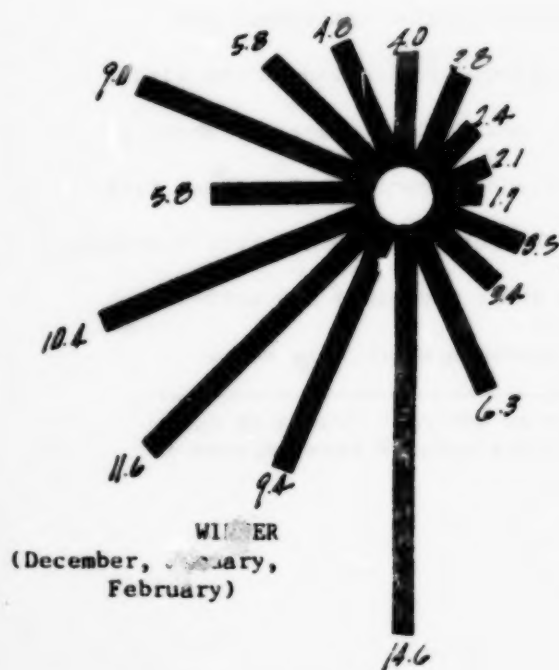
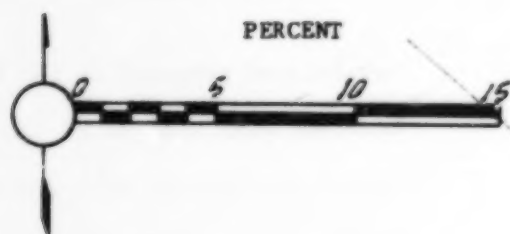


Table 2. Average Mixing Depths for
Cleveland Area by Season

Season	Mixing Depths, meters		
	Average Morning	Average Afternoon	Average, morn. and afternoon
Winter (Dec., Jan., Feb.)	515	750	630
Summer (June, July, Aug.)	315	1580	1010
Annual (4 seasons)	428	1233	897

tabulations prepared by the National Weather Records Center (NWSA).

Combined with wind data, these data are used in the diffusion model to assess the spatial distribution of concentrations of suspended particulates, sulfur oxides, and carbon monoxide.

Suspended Particulates

The Ohio Air Sampling Network was designed to provide data on suspended particulates from hi-vol samplers located throughout the state. In the Cleveland study area, stations are located in the cities of Cleveland, Lorain, Akron, Painesville, and Canton. Figure 9 shows a comparison of annual average particulate concentrations* for these five cities with the Ohio state average and the national average (291 stations).³ Three of these five cities had averages above the state and national levels while Lorain and Painesville had averages which were below.

* These values range from two to four year averages depending upon when and how long samplers from the state network were located in each area.

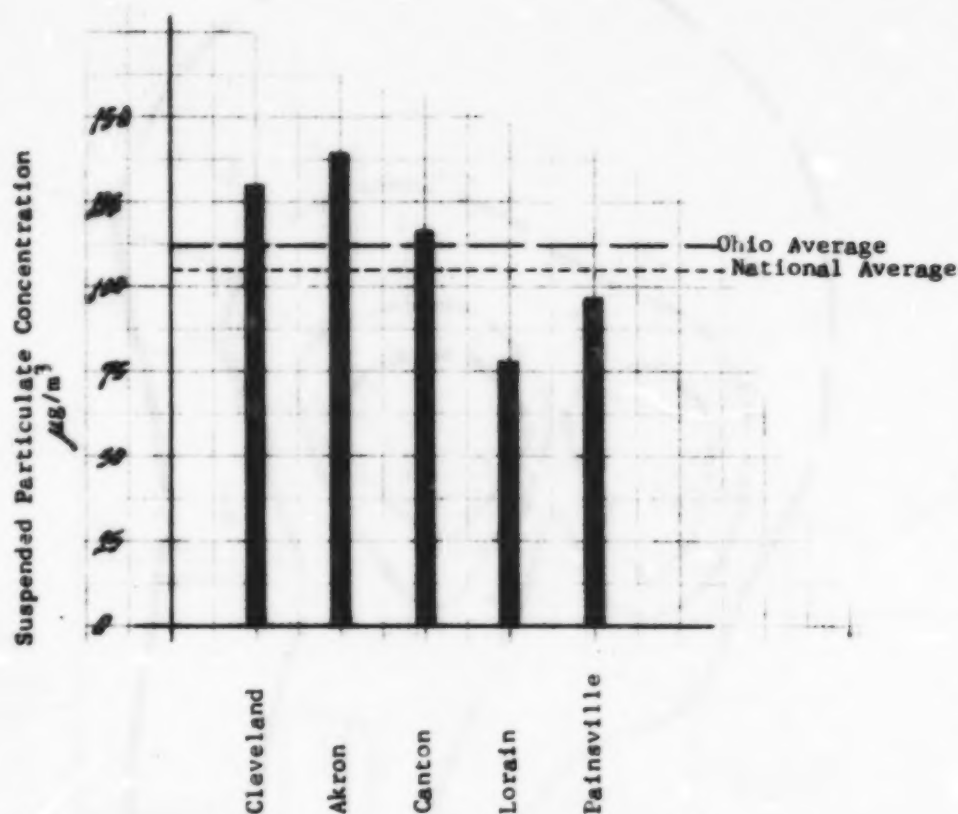


Figure 9. Comparison of suspended particulate concentrations of five Ohio cities with the Ohio average and the national average.

In the rural areas lying between and around these cities, however, no pertinent hi-vol data exists. A diffusion model analysis of suspended particulate concentrations was made to estimate concentrations in these areas. Figure 10 shows the resulting concentration isopleths for the summer months.* Plotted on the same figure are summer averages of the five cities for the summers of 1966 and 1967. The model results and the actual measurements tend to support one another except in the Painesville area.

* Diffusion model contours were adjusted by a factor of 1.5 so that values would correspond more closely to actual sampling data.

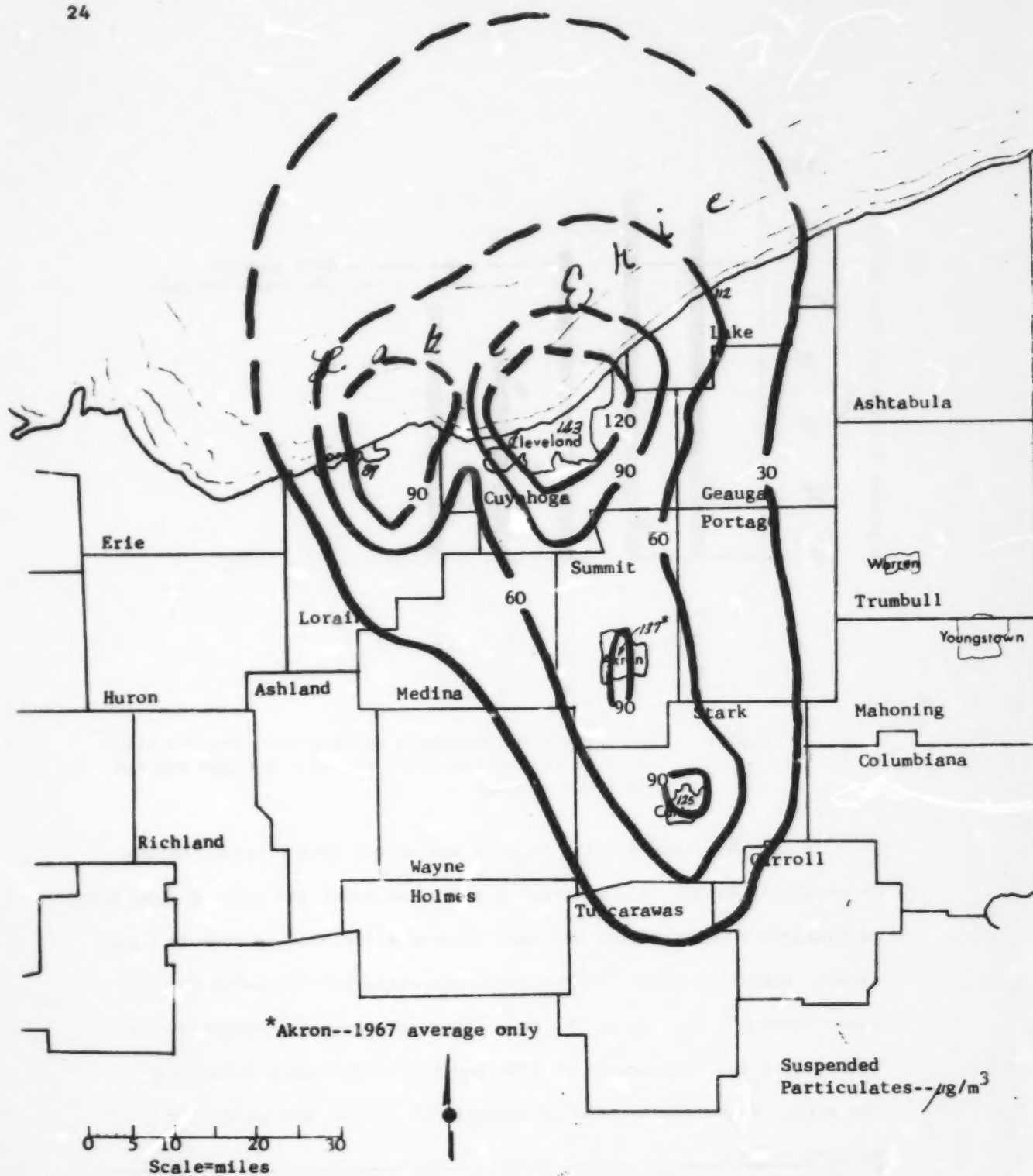


Figure 10. Theoretical summer suspended particulate concentrations and actual concentrations for summers 1966 and 1967.

The contours of Figure 10 were produced using emissions from the study area only. Had emissions from Youngstown and Steubenville been included in model calculations, such a rapid decrease in particulate levels would not have occurred to the east of the Cleveland-Akron-Canton corridor. In fact, the $30 \mu\text{g}/\text{m}^3$ contour probably would not have shown at all on this figure since it is below the value of $35\text{-}40 \mu\text{g}/\text{m}^3$ generally assumed to be background level of suspended particulates. The figure does point out, however, that there are four major centers of high particulate concentration in the study area, and all four should be considered for inclusion in the Region.

Carbon Monoxide

Figure 11 shows annual theoretical relative contours of carbon monoxide. The peak lies in Cleveland corresponding to the maximum traffic density. The contours are elongated in the direction of Akron and Canton. Since CO emissions from Youngstown were not included in the diffusion model, the relative values of the isopleths fall quite rapidly to the east of the Cleveland-Akron-Canton corridor.

Sulfur Oxides

Figure 12 shows diffusion model estimates of sulfur oxides concentrations. Three centers of concentration are apparent from Figure 12--Cleveland, Lorain and Akron. These centers correspond to the emission inventory which shows that Cuyahoga, Lorain, and Summit Counties, respectively, have the highest SO_x emissions in the study area.

Also shown on Figure 12 are the averages of SO_x sampling data for the first six months of 1968 in Cleveland, Akron, Lorain, and Canton.

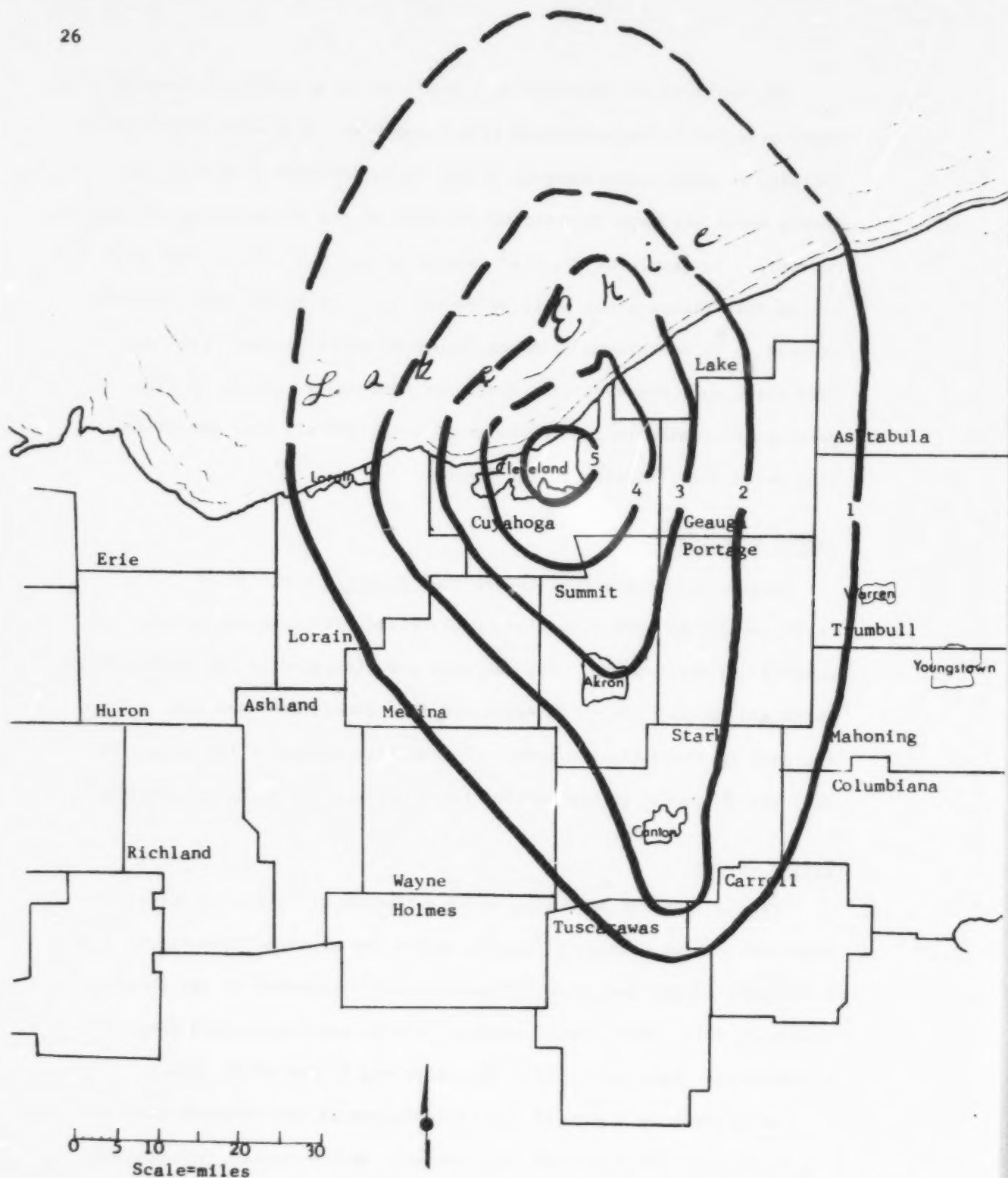


Figure 11. Theoretical relative CO contours (annual average).

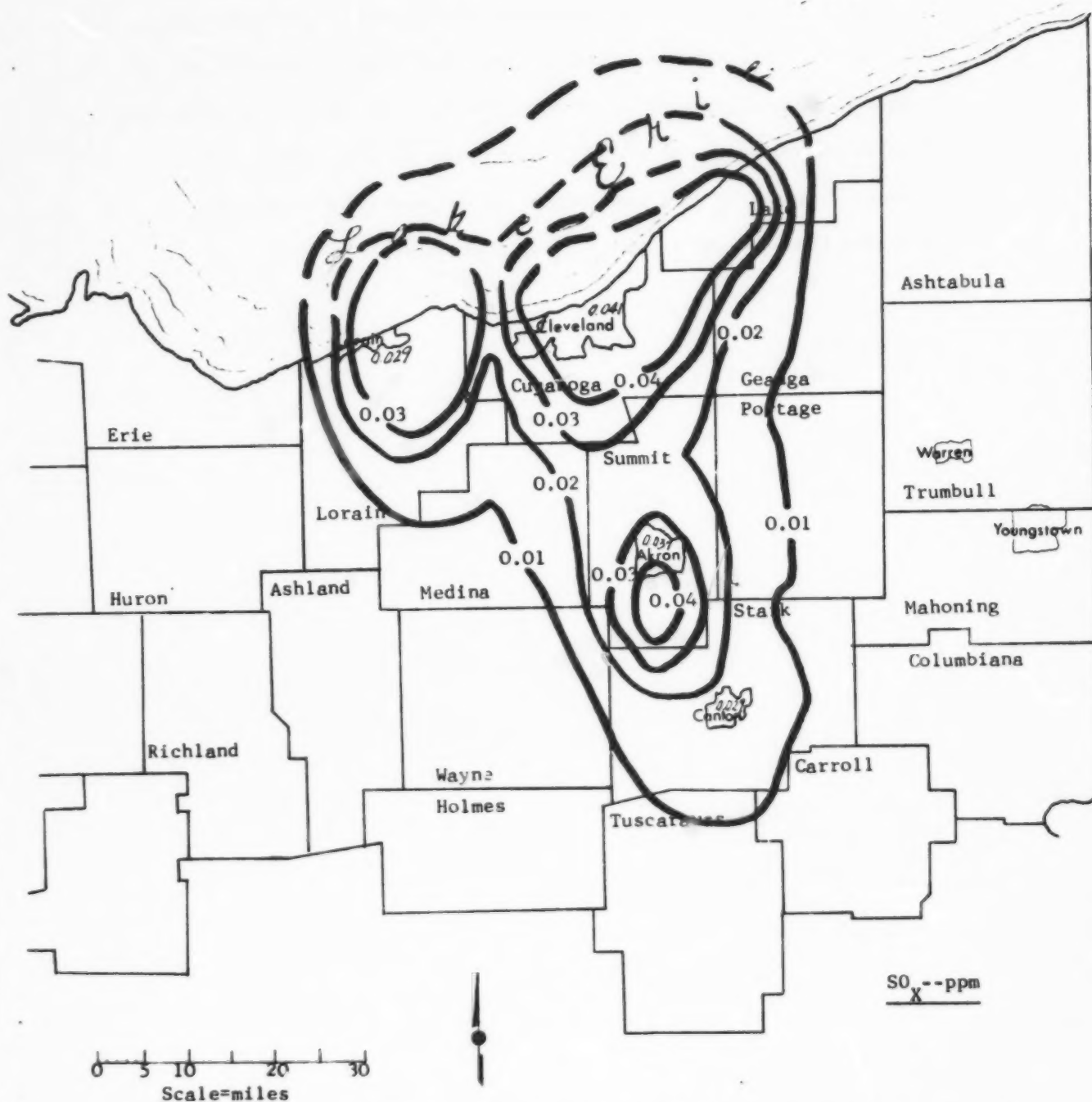


Figure 12. Theoretical annual SO_x concentration contours and actual SO_x sampling data for first six months of 1968.

These data correspond quite closely to the theoretical diffusion model contours.

Figure 12 shows SO_x concentrations of 0.01 ppm or greater. The 0.01 ppm SO_x diffusion model isopleth has been used in previous region designations as a guide in determining the size of the region since this value is considered to be close to background levels. Again, this contour is presented as a theoretical value produced by using SO_x emissions from the eight-county study area only.

EVALUATION OF URBAN FACTORS

INTRODUCTION

A number of urban factors are relevant to the problem of defining air quality control region boundaries. First, the location of population is an important consideration, since human activity is the ultimate cause of air pollution, and humans are the ultimate victims. The population growth pattern is another important consideration, since an air quality control region should be designed not only for the present but also for the future. The location of industrial activity and the industrial growth pattern are relevant considerations for similar reasons. Political and jurisdictional considerations are important also, since the 1967 Air Quality Act envisions regional air pollution programs based on cooperative efforts among many political jurisdictions. The following discussion of urban factors will present these considerations as they apply to the Cleveland area.

POPULATION

Figure 13 and Table 3 display present population and population densities in Cleveland and the surrounding areas. About 800,000 people reside within the City of Cleveland, which represents about one quarter of the population of the eight counties in the study area (Cuyahoga, Lorain, Lake, Summit, Stark, Medina, Portage, and Geauga). An approximately equal number of people reside in suburban areas outside of the city limits but still within Cuyahoga County. In other words, more than half of the total eight county population resides within the whole of

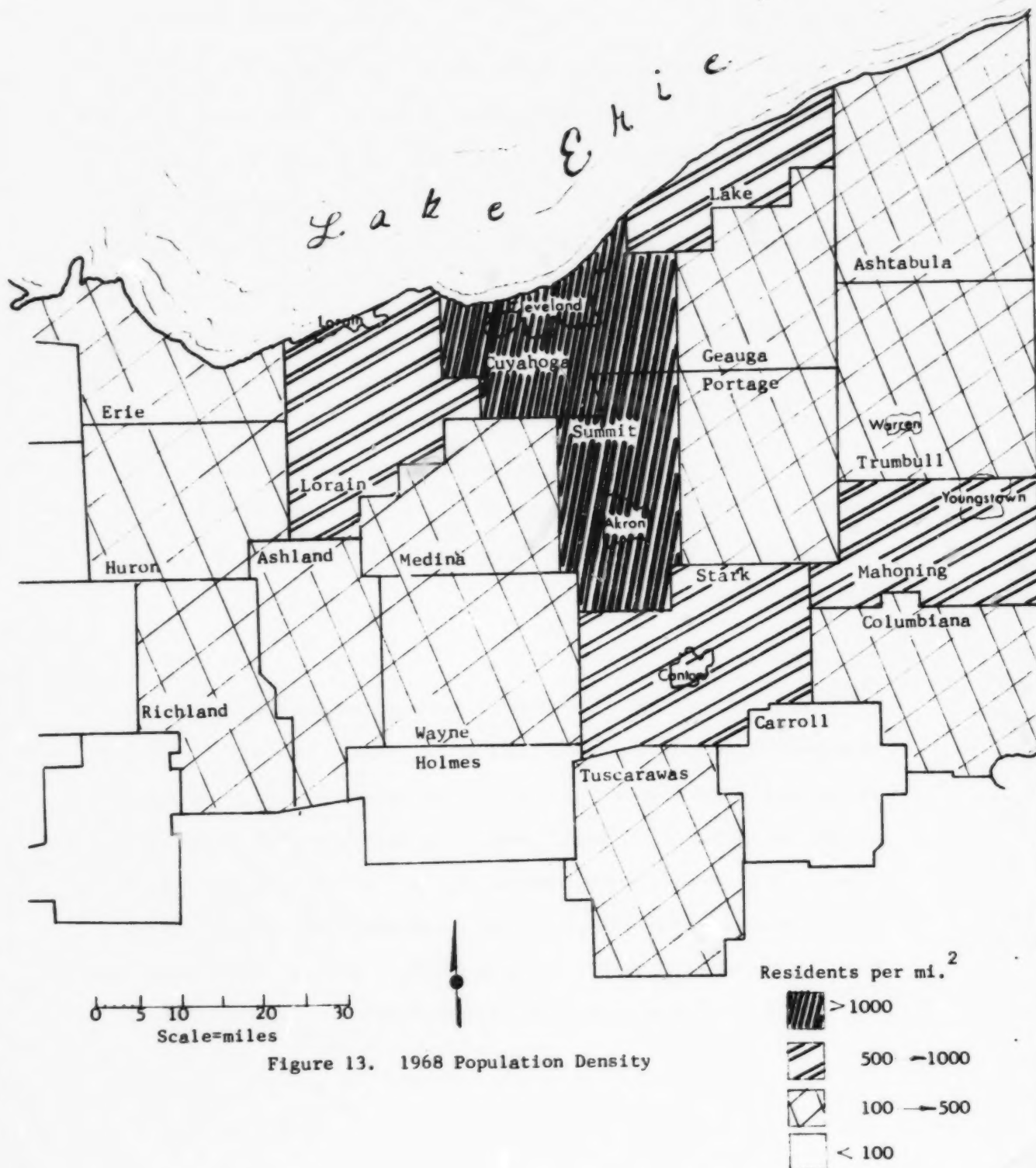


Figure 13. 1968 Population Density

Table 3. Present and Future Population by Jurisdiction

County	Area, mi. ²	Population 1968	Population Density 1968 residents/ mile ²	Expected Population 1980	Population Density 1980 residents/ mile ²	Additional Residents per mi. ² 1968-1980
Ashland	418	42,400	101	50,200	120	19
Ashtabula	706	101,400	143	114,100	162	19
Carroll	388	21,900	56	22,800	59	3
Columbiana	535	109,800	205	118,800	222	17
Cuyahoga	456	1,700,000	3720	1,894,400	4150	430
Erie	264	79,900	302	98,100	372	70
Geauga	407	58,000	143	87,200	214	71
Holmes	423	23,700	56	25,300	60	4
Huron	497	52,800	106	60,500	122	16
Lake	232	182,000	785	261,300	1125	340
Lorain	495	264,000	532	309,800	625	93
Mahoning	419	305,000	729	331,200	791	62
Medina	424	73,000	172	104,700	247	75
Portage	504	111,000	220	147,300	292	72
Richland	497	133,000	268	151,700	305	37
Stark	573	363,000	616	417,800	728	112
Summit	413	550,000	1330	637,200	1542	212
Trumbull	620	227,000	366	277,000	447	81
Tuscarawas	551	79,800	145	89,800	163	18
Wayne	551	88,300	160	99,500	181	21

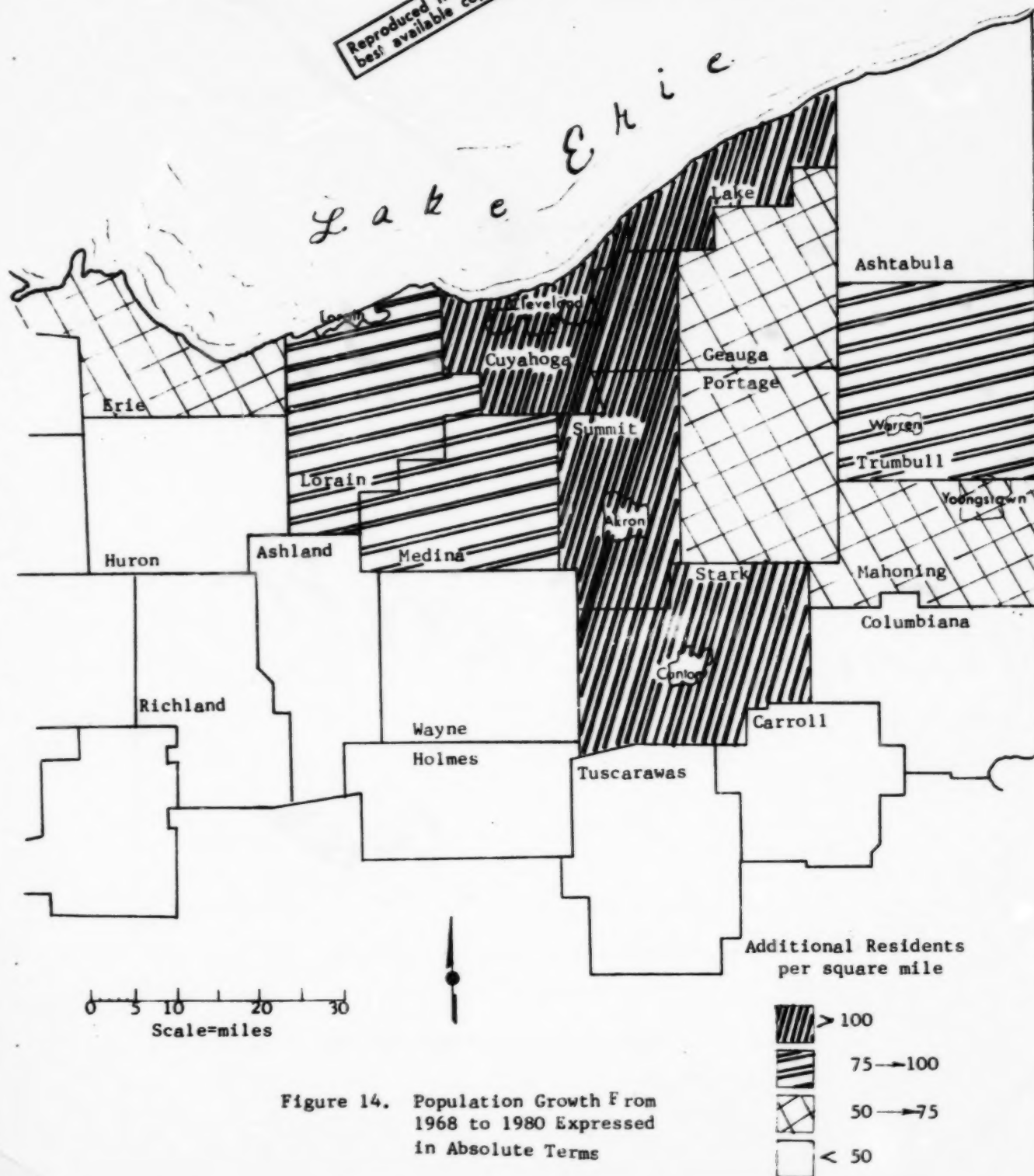
Cuyahoga County. As a result Cuyahoga County has by far the heaviest population density of any county in the area with approximately 3700 residents per square mile. The remaining portion of the eight-county population consists of about 1,500,000 people. Of these, about two-thirds live in Summit, Lake, and Lorain counties, which have the next highest population densities. Except for Trumbull and Mahoning Counties (which contain the Cities of Warren and Youngstown), the counties adjacent to the eight-county area have relatively low population densities.

Population growth⁴ during the next decade is also represented in Table 3 and in Figure 14. The largest amount of absolute growth will probably take place in Cuyahoga County, with about 430 additional residents per square mile. Lake County ranks second with about 340 additional residents per square mile, followed by Summit with 212. Stark County will probable have over 100 additional residents per square mile. Thus, by 1980, Cuyahoga will have around 4150 residents per square mile, Summit about 1500, Lake about 1100, and Lorain and Stark between 650 and 750. Adjacent counties except for Mahoning County will probably have less than 500 residents per square mile. The major portion of growth will probably have occurred in Cuyahoga, Lake, Summit, and Stark Counties.

INDUSTRY

Two methods are used to indicate the location of manufacturing activity. First, the land use map, Figure 15, displays industrial areas. It demonstrates three spokes of industrial activity radiating outward

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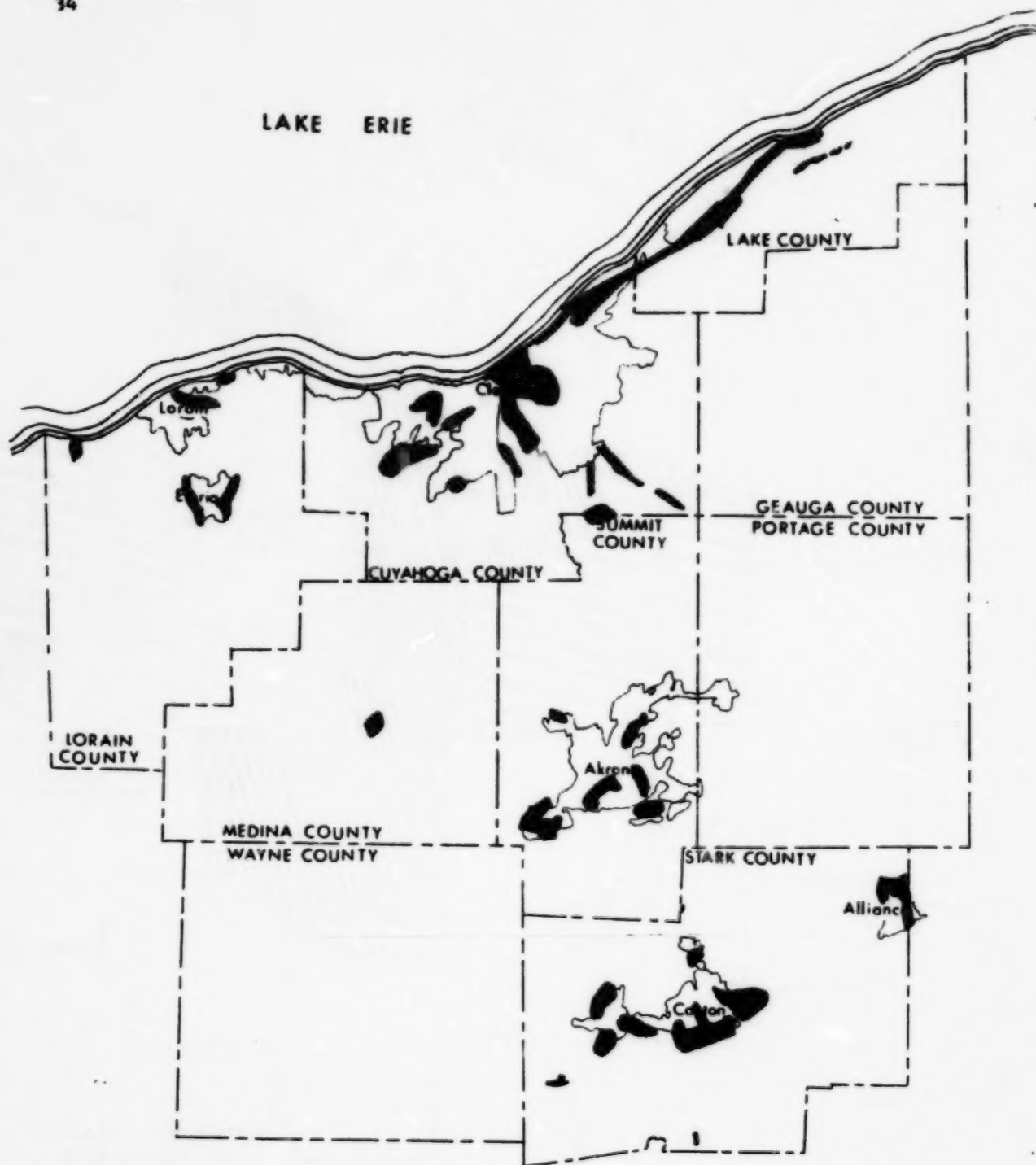


Figure 15. Industrial Land Use

from Cleveland to Lake County eastward, Lorain County westward, and Summit and Stark Counties southward. Medina and Portage Counties, in contrast, do not contain noticeable concentrations of industrial activity. A second method for presenting the location of manufacturing activity can be based on the density of people employed in manufacturing firms. According to 1963 data, Figure 16⁶ shows that Cuyahoga County has by far the highest density of manufacturing employees with 565 per square mile. Summit County (with Akron) ranks second, with 204 manufacturing employees per square mile. Stark County ranks third, followed by Mahoning, Lake, and Lorain Counties.

EXISTING AIR POLLUTION PROGRAMS

In the State of Ohio, responsibility for air pollution control rests upon an Air Pollution Control Board located within the State Department of Health. In order to meet its responsibility, the Board is authorized to prescribe ambient air quality standards for various sections of the State, to enforce emission standards designed to meet the air quality standards in those sections, and to issue variance permits for exceptional circumstances. The State program has an annual budget of approximately \$250,000.

Under existing law in Ohio, county governments can develop air pollution control programs only as part of their health program. County regulations concerning air pollution control do not apply within municipal boundaries if the city or incorporated area has its own regulations. Due to this limitation on county jurisdiction, municipal government has become the most usual unit in Ohio for administration of local air

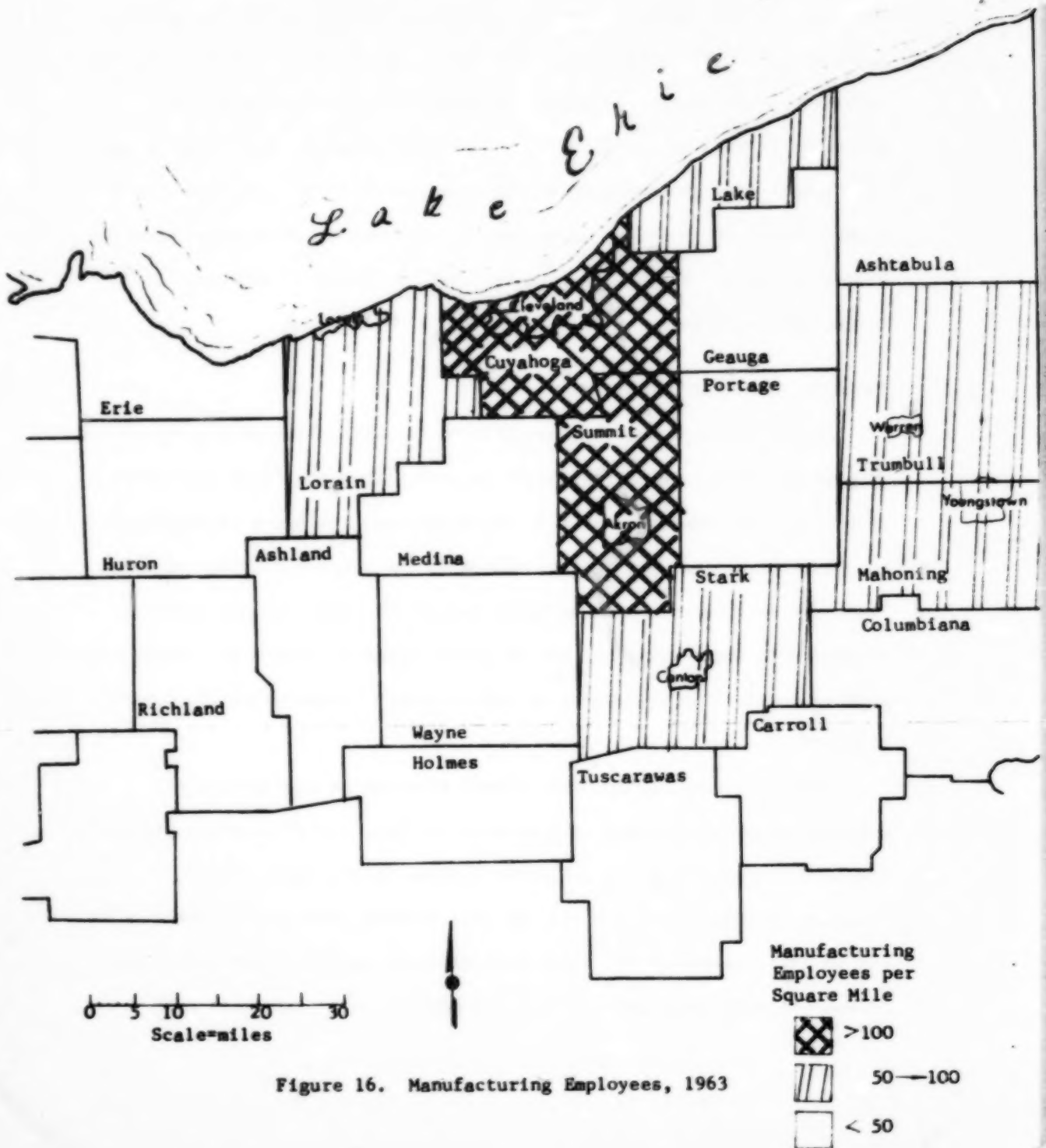


Figure 16. Manufacturing Employees, 1963

pollution control programs. For example, in the Cleveland area local control programs are operated by the City of Cleveland, the Cities of Akron and Barbertown, the City of Canton, and the City of Lorain. County programs in the area are either very small, or nonexistent. Table 4 gives the budget levels of the four city programs. Their annual operating budgets range from about 400,000 dollars for Cleveland's program to about 33,000 dollars for Lorain's program. Except for Cleveland, all of the programs were established during 1965 or later. The program budgets have been rising rapidly during the last few years in every case.

Table 4.
Annual Operation Budgets

Cleveland	~\$400,000
Akron-Barbertown	~\$130,000
Canton	~\$ 70,000
Lorain	~\$ 33,000

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The jurisdiction of these four city programs does not extend past municipal boundaries. Therefore, none of the separate jurisdictions share a common boundary. Due to this and other factors, no provisions for cooperative activities have been established between these programs. The various functions of data collection, emission inventory study, setting of regulations, enforcement of regulations, and program planning are carried out independently by the four programs. At the present time, there is no mechanism which provides regional coordination in air pollution control activities.

REGIONAL PLANNING IN THE CLEVELAND AREA

Although no institution presently conducts regional planning of air pollution control in the Cleveland area, other regional planning

functions are being carried out by two multi-county agencies. First, the Seven County Transportation Land Use Commission covers a planning jurisdiction including part or all of Cuyahoga, Summit, Lake, Lorain, Medina, Portage, and Geauga Counties. Its activities have been related to transportation planning and the preparation of land use plans predominately. Second, the Tri-County Regional Planning Commission includes Medina, Summit, and Portage Counties. Regional planning on a county-wide basis is performed in Stark County by the County Regional Planning Commission.

THE PROPOSED REGION

Subject to the scheduled consultation, the Secretary, Department of Health, Education, and Welfare, proposes to designate an air quality control region for the Cleveland area, consisting of the following jurisdictions:

Cuyahoga County

Geauga County

Lake County

Lorain County

Medina County

Portage County

Stark County

Summit County

As so proposed, the Metropolitan Cleveland Intrastate Air Quality Control Region would consist of the territorial area encompassed by the outermost boundaries of the proposed counties. The proposed region is illustrated in Figure 17. Figure 18 locates the region in relation to the rest of Ohio and the surrounding states.

DISCUSSION OF PROPOSAL

To be successful, an air quality control region should meet three basic conditions. First, its boundaries should encompass most pollution sources as well as most people and property affected by those sources. Second, the boundaries should encompass those locations where industrial and residential development will create significant air pollution problems in the future. Third, the

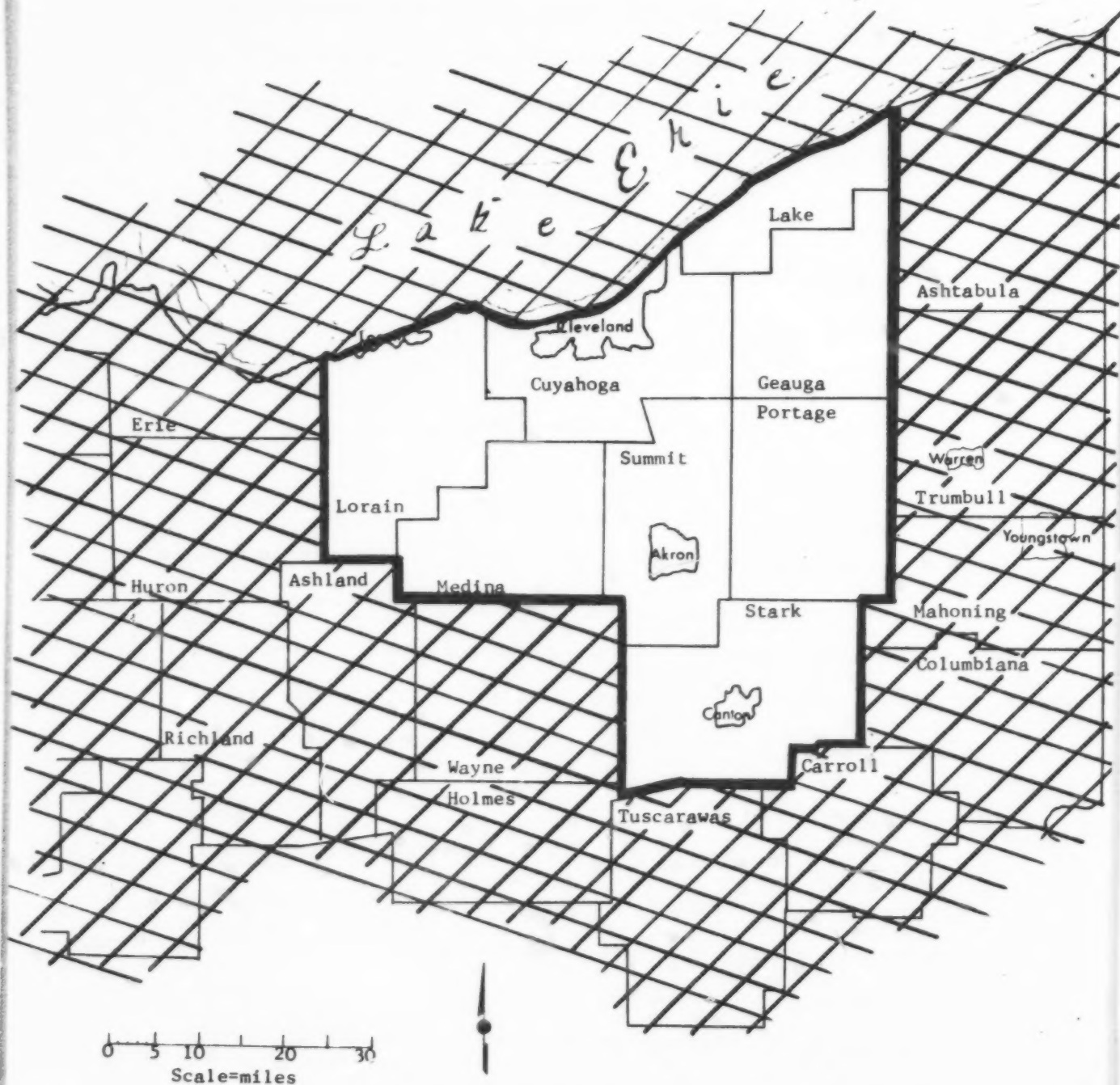


Figure 17. Proposed Greater Metropolitan Cleveland Intrastate Air Quality Control Region

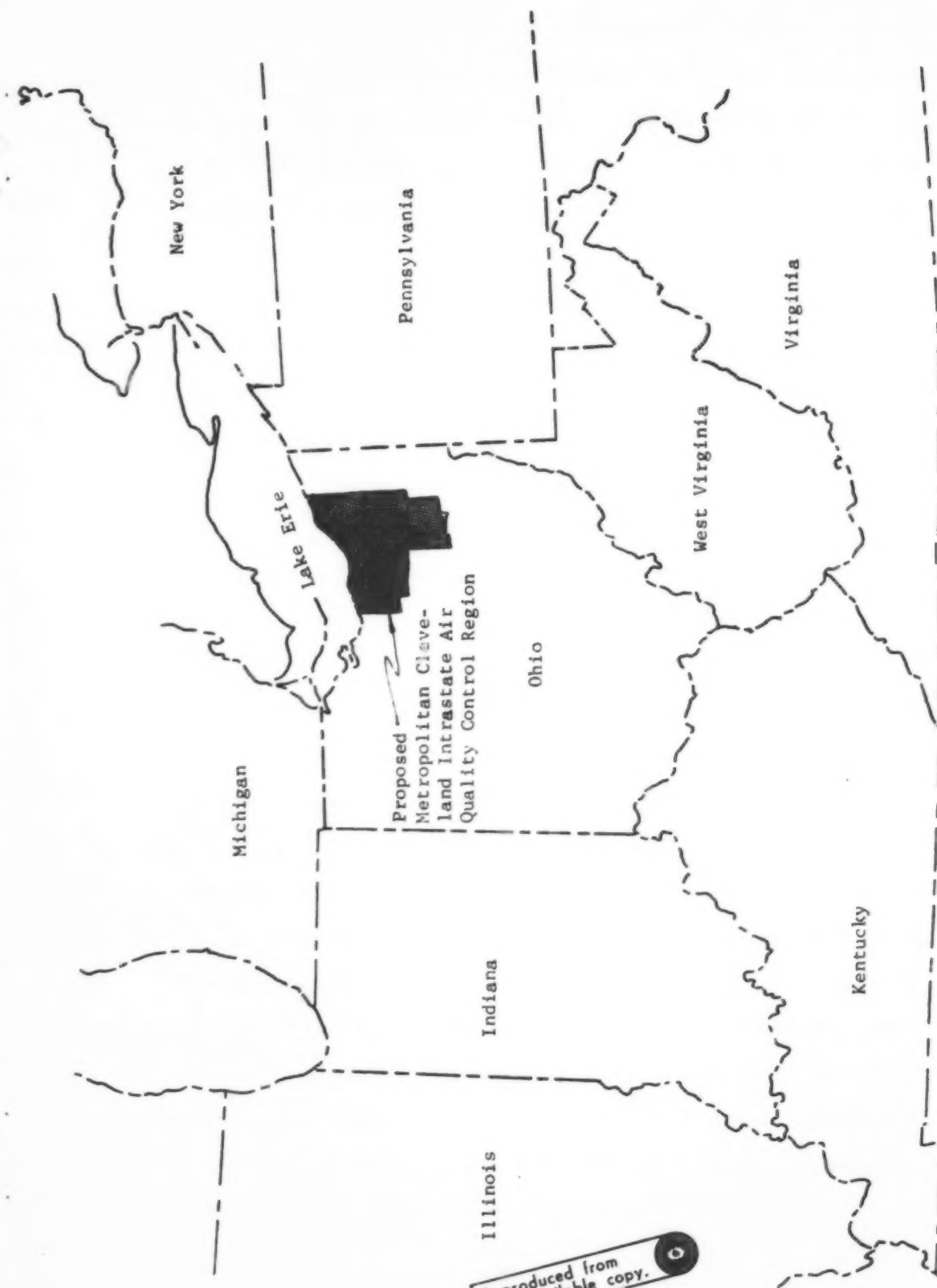


Figure 18. Relationship of Proposed Metropolitan Cleveland Inland Intrastate Air Quality Control Region to Surrounding Areas.

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boundaries should be chosen in a way which is compatible with and even fosters unified and cooperative governmental administration of the air resources throughout the region. The "Evaluation of Engineering Factors" (discussion beginning with Page 12) discussed the first of these conditions, and the "Evaluation of Urban Factors" (Page 29), the second and third.

Within the proposed Air Quality Control Region, a T-shaped group of five counties (Lorain, Cuyahoga, Lake, Summit, and Stark) form what might be called the core of the region. The center of the core, of course, is Cuyahoga County, where more than one half of the eight county study area's population resides. Over 92 percent of the eight county population live in the five-county T-shaped core. A study of the emission density maps (Figures 4, 5, and 6) and the point source location map (Figure 7) supports the same conclusion. Diffusion model estimates of pollutant concentrations show peaks in the cities of Cleveland, Lorain, Akron, and Canton; actual sampling data substantiate these estimates.

Stark County, located at the southern tip of the T-shaped core area, is less directly linked to Cleveland than any of the other core counties. Canton, the center of Stark County, lies less than 20 miles from Akron, about forty-five miles from Youngstown, and about 50 miles from Cleveland. The question arises whether or not Stark County should be associated in a region with Youngstown rather than Cleveland. In a recent publication⁵ entitled "A Survey of Air Pollution Emissions in Stark County, Ohio", relevant points were made concerning interaction between Stark and surrounding counties. According to Steiner, the possible air pollution interaction between

Canton and Akron is greater than that between Canton and Youngstown. During certain adverse meteorological conditions, emissions from Canton can cause significant concentrations of SO_x to occur in Akron, and visa versa. It was also concluded that even during the winter months when emissions are greatest in Youngstown, it is unlikely that Canton is affected by them. Steiner sums up his comments:

"Because of its distance from the study area [Stark County], low frequency of pertinent winds, and its topographic features, Youngstown does not exchange pollutants to a significant degree with Stark County. Interactions between Akron and the Canton-Massillon area are most common with the resultant transport of pollutants being from Stark County toward Akron due to the higher frequency of winds favorable for such transport."⁵

The diffusion model maps presented in this report suggest some interaction between Cleveland, Akron and Canton insofar as the isopleths are generally elongated in a NNW-SSE direction. Thus, all things considered, Canton appears to be more closely linked to Akron and Cleveland than to Youngstown. The inclusion of Stark County in the Cleveland Region is therefore recommended.

The other three counties proposed for inclusion in the Region--Medina, Geauga, and Portage--lie on the fringe of the core area. Diffusion model estimates of SO_x concentrations indicate that more than half of all three counties are affected by SO_x concentrations of 0.01 ppm or more and above background levels of suspended particulates. All three counties are part of the Seven County Transportation Land Use Commission. And Medina and Portage are part of the Tri-County Regional Planning Commission with Summit County. Inclusion of the three counties will provide a buffer zone along two sides of the Cleveland-

Akron-Canton corridor which provides room for the core area to expand within the Air Quality Control Region in the future.

As is true of most efforts to draw boundaries around an area to differentiate it from its surroundings, there is always a likelihood of boundary conditions existing or developing. In the case of air quality control regions, such a boundary condition would exist where sources of pollution on one side of the region boundary affect in some real way air quality on the other side of the boundary.

Relocating the boundary would only rarely provide relief from this condition. The solution is to be found in the way in which control efforts are implemented following the designation of an air quality control region. Consonant with the basic objective of providing desirable air quality within the problem area being designated as an air quality control region, the implementation plan that follows the designation should have provisions for the control of sources located close to but beyond the region boundaries. The level of control for such sources should be a function of, among other factors, the degree to which emissions from sources cause air quality levels to exceed the standards chosen for application within the Air Quality Control Region.

In summary, the Region proposed is considered on the whole to be the most cohesive and yet inclusive area within which an effective regional effort can be mounted to prevent and control air pollution in the Cleveland area.

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